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A NEW CRAYFISH OF THE SUBGENUS
PUNCTICAMBARUS FROM THE SAVANNAH RIVER
DRAINAGE WITH NOTES ON *CAMBARUS* (*P.*)
REBURRUS PRINS (DECAPODA, ASTACIDAE)

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The new crayfish described below represents the second member of the subgenus *Puncticambarus* known to inhabit headwater streams of the Savannah River. Prins (1968) described *Cambarus reburrus* from a single tributary in Jackson County, North Carolina, and although he searched in other streams in the area, he was unable to find it elsewhere. Unknown to Prins, but about the same time, Gregory L. Dougherty collected specimens of *C. reburrus* from several tributaries of the French Broad River in the vicinity of Black Mountain, Buncombe County, North Carolina. Furthermore, juvenile specimens that the junior author had tentatively assigned to *C. acuminatus* Faxon, 1884, had been obtained from three additional localities in the French Broad drainage system.

In view of the facts that *C. reburrus* seems to be widely dispersed in the French Broad drainage and that the type-locality is the only one situated outside of it, it seems possible, if not probable, that the population described by Prins in the headwaters of the Savannah River is an introduced one. That the type-locality is on "a short tributary leading from an impoundment (Sapphire Lake) . . ." (Prins, loc. cit., p. 458) provides

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all the more reason to suspect that this population was derived from the "left-overs" of a fisherman's bait bucket. Because the range of *C. reburrus* is so poorly known, the unpublished localities are cited below.

We wish to thank all of those who have assisted in obtaining specimens of *C. reburrus* and the new species for us, particularly Mr. Dougherty who donated the fine series from the Black Mountain area. We are grateful to Fenner A. Chace, Jr. and Martha R. Cooper for their criticisms of the manuscript and to Carolyn B. Gast for the illustrations.

Cambarus (Puncticambarus) reburrus Prins

Cambarus acuminatus.—Faxon, 1884: 114, 144 [part]; 1885: 68, 178 [part].—Underwood, 1886: 365 [part].—Faxon, 1890: 624 [part].—Hay, 1899: 959 [part].—Harris, 1903: 59, 68, 137, 147, 154, 156 [part].—Ortmann, 1913: 336, 366 [part].—Newcombe, 1929: 279, 280 [part].—Brimley, 1938: 503 [part].

Cambarus montanus acuminatus.—Ortmann, 1931: 110, 118 [part].—Crocker, 1957: 42 [part].

Cambarus reburrus Prins, 1968: 458–461, 11 figs.

"advanced relative . . . of *C. (V.) pristinus*" Hobbs, 1969: 167.

Type-locality: "Small tributary to the Horsepasture River from Sapphire (= Fairfield) Lake off U.S. 64, 5.5 miles east of Cashiers, Jackson County, North Carolina." [Savannah River Drainage].

All except the latter two references included in the synonymy are based on misidentifications made by Faxon (1884: 114) and/or Ortmann (1931: 110) on specimens obtained from the Swannanoa River at Asheville and Black Mountain, Buncombe County, North Carolina.

Additional Localities: NORTH CAROLINA [French Broad River Drainage], Buncombe County—Several localities in the immediate vicinity of Black Mountain, 9♂ I, 3♂ II, 6♀, 17 juv. ♂, 25 juv. ♀, collected in 1967 and 1970, G. L. Dougherty, coll.; 2.1 miles east of Swannanoa, 2j♂, 3j♀, 5 Sept. 1949, W. R. West and H. H. Hobbs, Jr., coll. Madison County—3.5 mi. west of Old Fort in Pisgah National Forest on U.S. Hwy. 70., 1j♂, 17 June 1940, J. C. Moore, coll. These specimens are somewhat atypical and are thus tentatively assigned to this species. Transylvania County—Davidson River at the junction of U.S. Hwys. 64 and 276, 1j♂, 25 June 1957, E. A. Crawford, Jr., coll. All of these specimens are deposited in the Smithsonian Institution.

Dougherty found first form males in the Buncombe County localities in February, March, and July, and Prins (loc. cit., p. 461) collected those in the type-series in April, May, and November.

Cambarus (Puncticambarus) chaugaensis new species

Cambarus (Puncticambarus) sp. E Hobbs, 1969: 102, 134, 135.

Diagnosis: Body pigmented, eyes moderately large and well developed. Rostrum with gently convergent margins, lacking marginal spines or tubercles. Areola 2.2 to 3.2 times longer than wide and comprising 29.3 to 35.5 (only one individual more than 34.8) percent of entire length of carapace with 5 to 8 punctations across narrowest part. Cervical spines comparatively small, only slightly larger than adjacent tubercles. Suborbital angle moderately strong, frequently acute. Postorbital ridges terminating cephalically bluntly in small subspiniform tubercles. Antennal scale approximately 2.5 times longer than broad, broadest slightly distal to midlength. Chela with width of palm greater than 1.3 times length of mesial margin, with 2 rows of tubercles along mesial surface of palm, mesial row consisting of 5 to 7 tubercles; distolateral margin of palm and fixed finger costate, and both fingers with well-defined longitudinal ridges on upper surface. First pleopod of first form male with moderately long, corneous central projection recurved caudally at angle of approximately 90 degrees, slightly tapering, and with subapical notch; mesial process noncorneous, somewhat inflated, with slenderer apical portion directed caudolaterally. Annulus ventralis slightly movable, shallowly embedded in sternum, subsymmetrical, and comparatively weakly sculptured.

Holotypic Male, Form I: Body subovate, depressed (Fig. 1a, j). Abdomen narrower than thorax (13.3 and 15.3 mm); greatest width of carapace greater than depth at caudodorsal margin of cervical groove (15.3 and 11.0 mm). Areola broad, 2.7 times longer than wide, with 7 punctations across narrowest part; length of areola 32.3 percent of entire length of carapace. Rostrum with slightly elevated, weakly swollen margins converging to base of acumen, then more abruptly tapering to slightly upturned, acute, corneous tip; latter reaching anteriorly to base of ultimate segment of antennular peduncle. Upper surface of rostrum weakly concave. Subrostral ridges very weak and evident in dorsal aspect to level of caudalmost margin of cornea of eye. Postorbital ridges well developed with small corneous, spiniform tubercles cephalically and deeply grooved dorsolaterally. Suborbital angle obtuse but clearly defined. Branchiostegal spines well developed. Small cervical spine on each side of carapace situated cephaloventral to small group of tuberosities. Carapace punctate dorsally, granulate laterally.

Abdomen longer than carapace (32.1 and 28.7 mm); pleura moderately long: first comparatively large; second subovate, rounded caudoventrally; and third through sixth truncate ventrally, rounded cephalo- and caudoventrally. Cephalic section of telson with 3 spines in each caudolateral corner, mesial 2 on each side articulated at base. Proximal podomere of uropod with strong spine on inner lobe; mesial ramus with well-developed dorsomedian keel terminating in small distal spine not

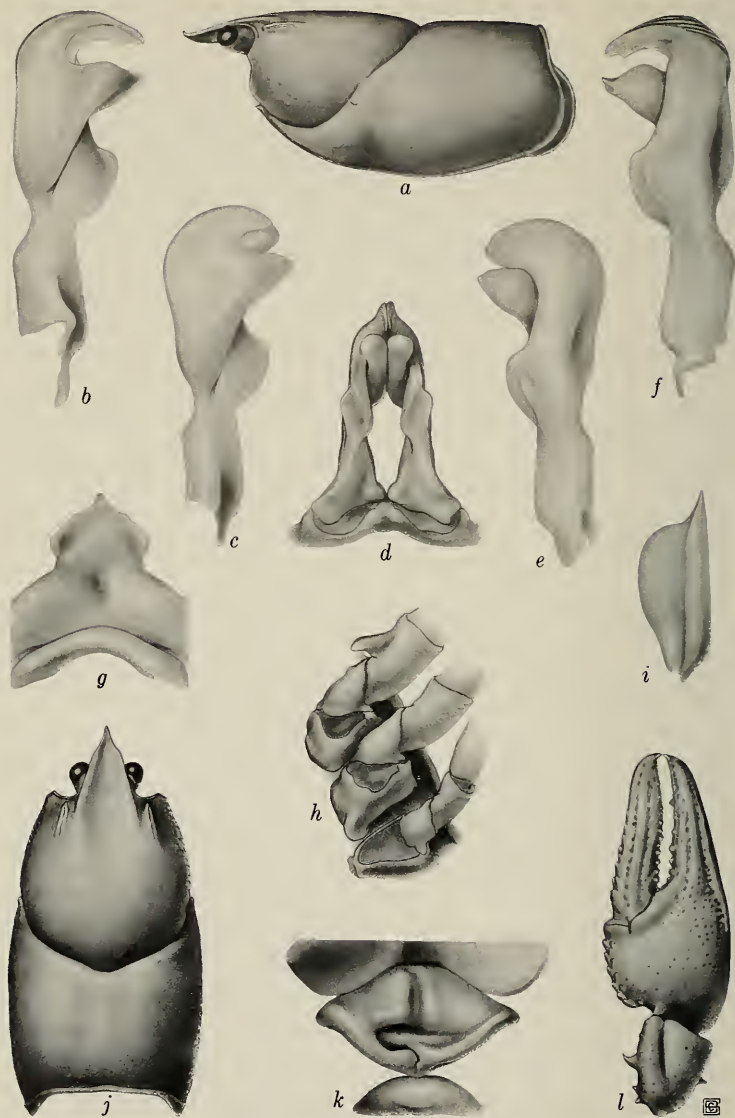


FIG. 1. *Cambarus chaugaensis* new species (pubescence removed from all structures illustrated). a, Lateral view of carapace of holotype. b, Mesial view of first pleopod of paratypic male, form I. c, Mesial view of first pleopod of morphotypic male. d, Caudal view of first

reaching distal margin of ramus; outer ramus with usual transverse row of small spines across distal margin of proximal section.

Projecting portion of epistome (Fig. 1g) subtriangular, broader than long with crenulated cephalolateral margins. Antennules of usual form with small median spine on ventral surface distal to midlength. Antennae reaching caudal margin of fourth abdominal tergite. Antennal scale (Fig. 1i) 2.5 times longer than broad, broadest slightly distal to midlength; mesial margin of lamellar area evenly rounded; thickened lateral portion terminating in prominent spine extending beyond tip of rostrum.

Right chela (Fig. 11) about twice as long as wide, somewhat depressed with inflated palm; inner margin of palm with row of 6 prominent tubercles, row of 6 weaker ones immediately dorsolateral to it, and single tubercle below and between fourth and fifth tubercles of mesial row; ventral surface of palm with small tubercle proximal to articulation with dactyl; remainder of palm punctate. Fingers only slightly gaping. Opposable margin of immovable finger with row of 9 tubercles (fourth from base largest) along proximal four-fifths, and with single acute one on lower level between seventh and eighth tubercle from base; row of minute denticles situated distal to fourth tubercle interrupted only by fifth and sixth; dorsal and ventral surfaces of finger with median longitudinal ridges flanked on both sides by punctate grooves, grooves deeper on dorsal surface; lateral margin costate; base of finger slightly impressed dorsally and ventrally. Opposable margin of dactyl with row of 12 tubercles along proximal four-fifths and minute denticles between, and distal to, third through twelfth tubercles; dorsal and ventral surfaces similar to those of immovable finger; mesial surface with prominent, rounded tubercles, diminishing in size distally, along proximal half of finger.

Carpus longer than broad (8.7 and 6.0 mm) with deep, slightly oblique longitudinal furrow on upper surface; dorsal and lateral surfaces punctate; mesial surface with centrally located prominent spiniform tubercle and smaller, stout, acute one proximal to it; ventral surface with 1 prominent submedian distal tubercle and knoblike one proximomesial to it.

Dorsal surface of merus tuberculate along distal half with cluster of

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pleopods of paratypic male. e, Lateral view of first pleopod of morphotypic male. f, Lateral view of first pleopod of paratypic male, form I. g, Epistome of holotype. h, Bases of third, fourth, and fifth pereopods of holotype. i, Antennal scale of paratypic male, form I. j, Dorsal view of carapace of holotype. k, Annulus ventralis and adjacent sternal elements of allotype. l, Dorsal view of distal podomeres of cheliped of holotype.

4 rounded tubercles near distal end; ventral surface of merus with single row of 11 tubercles corresponding to ventromesial row of other species; lateral row represented by only 2 large tubercles; laterodistal margin armed with slight tuberculate swelling. Ventromesial margin of ischium with row of 4 tubercles.

Hooks on ischia of third pereopods only (Fig. 1h); hooks strong and simple, extending proximally much beyond basioischial articulation and opposed by low tubercle on basis. Coxae of fourth pereopods with prominent caudomesial, obliquely vertically disposed, rounded boss; coxae of fifth pereopods without prominences. See Table I.

First pleopods (Fig. 1b, d, f) reaching coxae of third pereopods when abdomen flexed. See Diagnosis for description.

Allotypic Female: Differs from holotype in secondary sexual characters and the following: Base of acumen imperceptibly continuous with remainder of rostrum, rostral surface almost flat; suborbital angle spiniform; cephalic section of telson with only 2 spines in caudosinistral corner; cephalolateral margins of epistome less undulating; inner margin of palm of left chela with mesial row of 7 tubercles and adjacent dorsolateral row of 5; opposable margin of immovable finger with row of 6 tubercles and tubercle below row situated at base of distal fourth of finger; dactyl with only 10 tubercles on opposable margin; tubercle on ventral distolateral condyle of carpus more spiniform; dorsodistal cluster of tubercles on merus represented by 2 acute strong spines; mesioventral surface of merus with row of 8 tubercles on right cheliped, 10 on left, and with 1 and 2, respectively, lateral to row; ischia with row of 5 tubercles. First pleopods uniramous and reaching midlength of annulus when abdomen flexed. See Measurements (Table 1).

Annulus ventralis (Fig. 1k) subquadrangular, slightly movable, concave ventrally, with long low longitudinal ridges flanking cephalo-median trough in cephalic half; sinus originating at caudal end of trough, extending dextrally from median line, making hairpin turn and returning to median line, bending caudally and reaching caudal wall of annulus; tongue directed dextrad between horizontal arms of sinus. Sternal plate caudal to annulus subovate, approximately 3 times broader than long. See Table I.

Morphotypic Male, Form II. Differs from holotype in following respects: subrostral ridges evident in dorsal aspect to base of acumen; suborbital angle strongly acute; cephalic section of telson with 2 spines in each caudolateral corner; lateral lobe of proximal podomere of uropod with small spine but much more weakly developed than that on mesial lobe; epistome with cephalolateral margins more convex and less irregular; left chela (right regenerated) with only 5 tubercles in more lateral row on inner margin of palm; opposable margin of immovable finger with row of 10 tubercles, that of dactyl with 11; proximomesial surface of dactyl with greater number of tubercles; merus with ventromesial row of 8 tubercles; ischium with ventral row of 3; hooks on ischia of third pereopods much reduced, not over-reaching basio-

Table 1. Measurements (in mm) of *Cambarus chaugaensis* new species.

	Holotype	Allotype	Morphotype
Carapace			
Height	11.0	11.0	11.6
Width	15.3	14.6	16.6
Length	28.7	27.7	30.4
Rostrum			
Width	4.2	4.0	4.8
Length	6.0	6.2	4.8
Areola			
Width	3.4	3.4	3.8
Length	9.2	8.6	10.0
Chela			
Length, dactyl	14.7	11.5	16.8*
Length, palm	7.8	5.7	9.5
Length, outer margin of hand	24.8	18.6	29.0
Width, palm	11.2	8.5	13.7

* Left chela.

ischial articulation; boss on coxa of fourth pereopod also reduced. See Table 1.

First pleopod (Fig. 1c, e) with neither terminal element corneous and both with apices more rounded. Proximal opening of sperm groove not nearly so distinctly delimited as in holotype.

Type-locality: Chauga River at Cassidy Bridge (off County Road 290), Oconee County, South Carolina. This locality is in the upper southwestern corner of the State in the headwaters of the Savannah River. The Chauga River now empties into a relatively new impoundment, Lake Hartwell. At the type-locality, it is about of 40 feet wide and 3 feet deep in mid-channel during modal flows; substrates consist primarily of boulders and rocks.

Disposition of Types: All known specimens are deposited in the Smithsonian Institution: holotypic male, allotypic female, and morphotypic male (nos. 131926, 131927, and 131928, respectively). The paratype series consists of 25 males, Form I; 56 males, Form II; 45 females; 75 juvenile males; 62 juvenile females, and 11 ovigerous females.

Specimens Examined: All from tributaries of the Savannah River in Oconee County, SOUTH CAROLINA: (1) Type-locality, 11 ♂ I, 4 ♂ II, 7 ♀, 7 Nov. 1967, R. P. et al, coll.; 1 ♂ I, 1 ♂ II, 7 ♀, 28 July 1966, R. P. et al, coll.; 12 ♂ II, 1 ♀, 5j ♂, 2j ♀, 4 ovig. ♀, 17 May 1967, V. H. McCaskill and J. R. Cunningham, coll. (2) Ramsey Creek at U.S. Hwy. 76,

5 miles west of Westminster, 2 ♂ I, 3 ♀, 2j ♂, 3j ♀, 9 March 1967, R. P. and G. E. Dillard, coll.; 16j ♂, 10j ♀, 3 ovig. ♀, 23 April 1967, R. P., H. H. H., Jr., et al, coll.; 1 ♂ I, 1 ♀, 1j ♂, 1j ♀, 26 Nov. 1966, R. P. and G. E. D., coll. (3) Ramsey Creek, 0.6 miles west of S. C. Rte. 36, 1 ♂ II, 28 July 1966, R. P. et al, coll. (4) Tributary to Ramsey Creek (near headwaters), 4.5 miles northwest of Westminster, 1j ♂, 2j ♀, 13 Jan. 1967, R. P. et al, coll. (5) Village Creek at S. C. Rte. 258, 1 ♂ I, 9 ♂ II, 14j ♂, 10j ♀, 2 ovig. ♀, 17 May 1967, V. H. M. and J. R. C., coll. (6) West Village Creek at S. C. Rte. 258, 1 ♂ I, 3 ♂ II, 6 ♀, 28 July 1966, R. P. et al, coll. (7) Cane Creek at S. C. Rte. 183, near Walhalla, 7j ♂, 13j ♀, 23 April 1967, R. P., H. H. H., Jr., et al, coll.; 1 ♂ I, 6j ♂, 1j ♀, 26 Nov. 1966, R. P. and G. E. D., coll. (8) Cane Creek, 3 miles southwest of Walhalla on S. C. Rte. 28, 1 ♂ I, 1 ♂ II, 1 ♀, 1j ♂, 25 March 1951, E. C. Raney, et al, coll. (9) Cedar Creek, 5 miles west and 2 miles north of Walhalla, 2 ♂ I, 14 ♂ II, 14 ♀, 6j ♂, 14j ♀, 28 July 1966, R. P. et al, coll. (10) Seneca Creek, 0.1 mile south of U.S. Hwy. 76, 3 ♂ II, 3 ♀, 1j ♂, 1j ♀, 28 July 1966, R. P. et al, coll. (11) Rocky Fork Creek at Ramey's Mill, west of Westminster on U.S. Hwy. 76, 1 ♂ I, 1 ♀, 14 Oct. 1967, R. P. and G. E. D., coll. (12) Headwaters of Chauga River, 1.8 miles southeast of Mountain Rest on S. C. Rte. 28, 6 ♂ I, 2 ♂ II, 2j ♀, 25 March 1951, E. C. R. et al, coll. (13) Little Cane Creek, Walhalla, 23j ♂, 23j ♀, 28 March 19??, collector unknown. (14) 15 miles south of N. C.—S. C. state line on S. C. Rte. 28, 1 ♂ II, 1 ♀, 4 June 1962, W. S. Woolcott and J. S. Ramsey, coll. (15) Small stream west of Jocassee, 3 ♀, 15 May 1954, B. Martof, coll. (16) Whitewater River near Jocassee, 1 ♂ II, 1j ♀, 18 July 1952, coll. unknown. (17) Colonels Fork at S. C. Rte. 183, 2j ♀, 23 April 1967, R. P., H. H. H., Jr., et al, coll. (18) Stream between Long Creek and Chatooga on U.S. Hwy. 76, 3 ♂ II, 1 ♀, 13j ♂, 5j ♀, 2 ovig. ♀, 23 April 1967, R. P., H. H. H., Jr. et al., coll.

Size: The largest specimen available is a first form male having a carapace length of 38.9 mm, the smallest first form male, 25.1 mm. The largest female has a corresponding length of 38.0 mm, the largest ovigerous female, 34.7 mm, and the smallest ovigerous female, 25.2 mm.

Color Notes: Carapace olive green dorsally fading to light green lateroventrally, and mottled (conspicuously so dorsally) with dark olive brown to black markings; lower half of hepatic area and branchiostegites with large irregular splotches, those on caudodorsal surface of branchiostegites forming base of irregular and broken dorsolateral longitudinal stripes on abdomen; lateral surfaces of branchiostegites with splotches loosely united to form second band continuous with that extending along bases of pleura of abdomen. Dorsal surfaces of podomeres distal to ischia on chelipeds and other pereopods bearing coloration similar to that on body proper; carpus of cheliped with prominent proximo- and distolateral splotches as well as one at base of major mesial spine and another on mesiodistal angle; tips of fingers of chelae yellow.

lowish to red; ventral surfaces of pereopods and sternum cream-colored, and antennae reddish brown.

Relationships: *Cambarus chaugaensis*, although more closely allied to the members of the subgenus *Puncticambarus* than to *Cambarus*, has fewer than 8 tubercles on the mesial margin of the chela; consequently, utilizing Hobbs' key (1969: 95-96) to the subgenera, it would be identified as a member of the subgenus *Cambarus*. The broad, punctate areola in combination with the tapering rostrum, however, will serve to separate it from species belonging to the subgenus *Cambarus*.

Cambarus chaugaensis resembles most closely those members of the subgenus lacking marginal spines on the rostrum: *C. acuminatus*, *C. reburrus*, *C. robustus* Girard, 1852, and *C. veteranus* Faxon, 1914 (see Hobbs, 1969: 101-102). It may be distinguished from *C. acuminatus* by possessing a distinct suborbital angle and more weakly developed cervical spine. It differs from *C. reburrus* in having a shorter, more tapering rostrum, weaker cervical spines, and a chela that is more depressed, less setiferous, and having a shorter, broader palm (length of chela greater than 3 times length of inner margin of palm, less than 3 in *C. reburrus*; width of palm greater than 1.3 times length of inner margin, less than 1.3 in *C. reburrus*). The areola of *C. chaugaensis* is less than 3.5 times longer than broad whereas that of *C. robustus* and *C. veteranus* is greater than 3.5.

Life History Notes: First form males were collected in March, May, July, October, and November. The 11 ovigerous females were found in April and May. On the basis of the size ranges in the specimens examined, it seems probable that *C. chaugaensis* has a life cycle virtually identical to that outlined by Smart (1962) for *Cambarus longulus* Girard.

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